

CLAIMS

1. Two-dimensional detector of incident ionizing  
5 radiation composed of first particles, this detector  
comprising a stack (2) of sheets (4) of a first  
material capable of emitting second particles by  
interaction with the incident ionizing radiation, this  
detector being characterized in that it also comprises:
- 10 - layers (6) of a semiconducting material that  
alternate with sheets of the first material and  
may be ionized by the second particles, each of  
the layers being associated with one of the  
sheets, the stack having opposite first (8) and  
15 second (10) faces each containing corresponding  
edges (12, 14) of sheets and layers, the  
detector being designed to be laid out such that  
the ionizing radiation arrives on the first face  
(8), the length of each sheet measured from the  
20 first as far as the second face being equal to  
at least one tenth of the free average path of  
the first particles in the first material,
- groups of parallel and electrically conducting  
tracks (22) extending from the first to the  
25 second face parallel to the layers (6), each  
group being associated with one of the layers  
and in contact with it, the tracks being  
designed to collect charge carriers that are  
generated in the layers by interaction of the  
30 layers with the second particles and possibly  
with the first particles and that are  
representative of the first particles in  
intensity and in position, and

- means (26) of creating an electric field capable of causing collection of charge carriers through the tracks (22).

2. Detector according to claim 1, in which the  
5 first material is electrically conducting, the tracks (22) are electrically insulated from the sheets and the means of creating the electric field comprise means (26) of applying a voltage between the tracks (22) and the sheets (4), this voltage able to cause collection  
10 of charge carriers through the tracks.

3. Detector according to claim 1, in which each group of tracks (22) is fully located within the layer (6) with which it is associated.

4. Detector according to claim 3, in which the  
15 first material is electrically conducting and the means of creating the electric field comprise means (26) of applying a voltage between the tracks (22) and the sheets (4), this voltage able to cause collection of charge carriers through the tracks.

20 5. Detector according to either of claims 1 or 3, in which the sheets (4) are electrically insulating, an electrically conducting layer (46) is inserted between each layer (6) of semiconducting material and the sheet (4) that is associated with it and the means of  
25 creating the electric field comprise means (26) of applying a voltage between the tracks (22) and the electrically conducting layers (46), this voltage able to cause collection of charge carriers through the tracks.

30 6. Detector according to any one of claims 1 or 5, in which the semiconducting material may be chosen among the group including thin layers of diamond, CdTe, ZnTe, CdZnTe, AsGa and their alloys, InP, InSb, SiC,

crystalline silicon, amorphous silicon, organic crystals, amorphous selenium and chalcogenic glass ( $\text{As}_2\text{S}_3$ ).

7. Detector according to any one of claims 1 to 5 6, also comprising an electronic device (30) for reading electrical signals output by tracks (22) when the tracks collect charge carriers.

8. Detector according to claim 7, in which one end (32) of each track is curved to extend onto an edge 10 (14) of the corresponding layer (6) of semiconducting material, this edge being located on the second face (10) of the stack (2), and the device (30) comprises electrically conducting pads (34) that are in contact with the corresponding curved ends (32) of the tracks 15 (22).

9. Process for manufacturing the detector according to any one of claims 1 to 8, in which a layer (6) of semiconducting material is formed on each sheet (4), this layer being provided with the group of tracks 20 (22) associated with it, and the sheets provided with layers of semiconducting material and tracks are assembled together to obtain a stack (2) in which these layers of semiconducting material alternate with the sheets (22).

25 10. Process according to claim 9, in which a first layer of semiconducting material is formed on each sheet (4), the thickness being less than the thickness of the said layer (6) of semiconducting material, the group of tracks (22) is formed on this first layer and 30 a second layer of semiconducting material that covers these tracks is formed on the first layer, the total thickness of the first and second layers being equal to

the thickness of the said layer (6) of semiconducting material.

11. Process for manufacturing the detector according to any one of claims 1 to 8, in which a half  
5 layer of semiconducting material is deposited on the two opposite faces of two successive sheets (4), and then the group of tracks (22) is formed on one of the half layers and the sheets thus covered are assembled  
together to create a stack in which the layers  
10 alternate with the sheets.